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TECHNICAL NOTE

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COMPARING INVENTORY AND WOODS UTILIZATION STANDARDS IN SOUTHEAST ALASKA

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The timber inventory of the Tongass National Forest was a joint effort of Region 10 and the Alaska Forest Research Center (now the Northern Forest Experiment Station) of the Forest Service. Area and volume data to meet both National Forest management and Forest Survey needs were collected from 1955 through 1958. Inventory specifications to meet national and regional inventory standards were agreed upon by the cooperating Forest Service units.

The inventory stump heights and merchantable tops vary with tree diameter. Stump height equals d.b.h. (diameter breast height), except that a minimum 24-inch and a maximum 54-inch stump height is specified. The merchantable top equals 40 percent of d.b.h., but not less than 6 inches.

Recent woods utilization and residue studies made possible a comparison of top and stump utilization practices with standards specified by the inventory. Top and stump measurements for 330 trees were collected in the 1959-60 field seasons. The measurements came from 14 well dispersed logging chances representing major types of logging and ground conditions found in southeast Alaska. The full range of tree diameter classes (12-inches d.b.h. and larger) were represented in the sample, since the study areas were harvested by clear cutting.

Stump heights were lower than those specified in the inventory for all tree diameters (figure 1). Furthermore, the difference between inventory and utilized tree stump height increased significantly with tree diameter. For example, the stump height difference for 24- and 52-inch d.b.h. trees is 5.3 and 28.2 inches respectively. The lower stumps probably resulted from a preference to cut close to the ground with the average 25-pound power saw, rather than a deliberate attempt to get more complete utilization. Volume gains of 2 to over 300 board feet per tree resulted from cutting lower stumps (table 1). The greatest percentage gain in volume occurred in 56-inch d.b.h. trees, but actual volume gains continued to increase with tree diameter. This volume gain is important, particularly in a sawlog market, because higher quality wood is found in butt logs.

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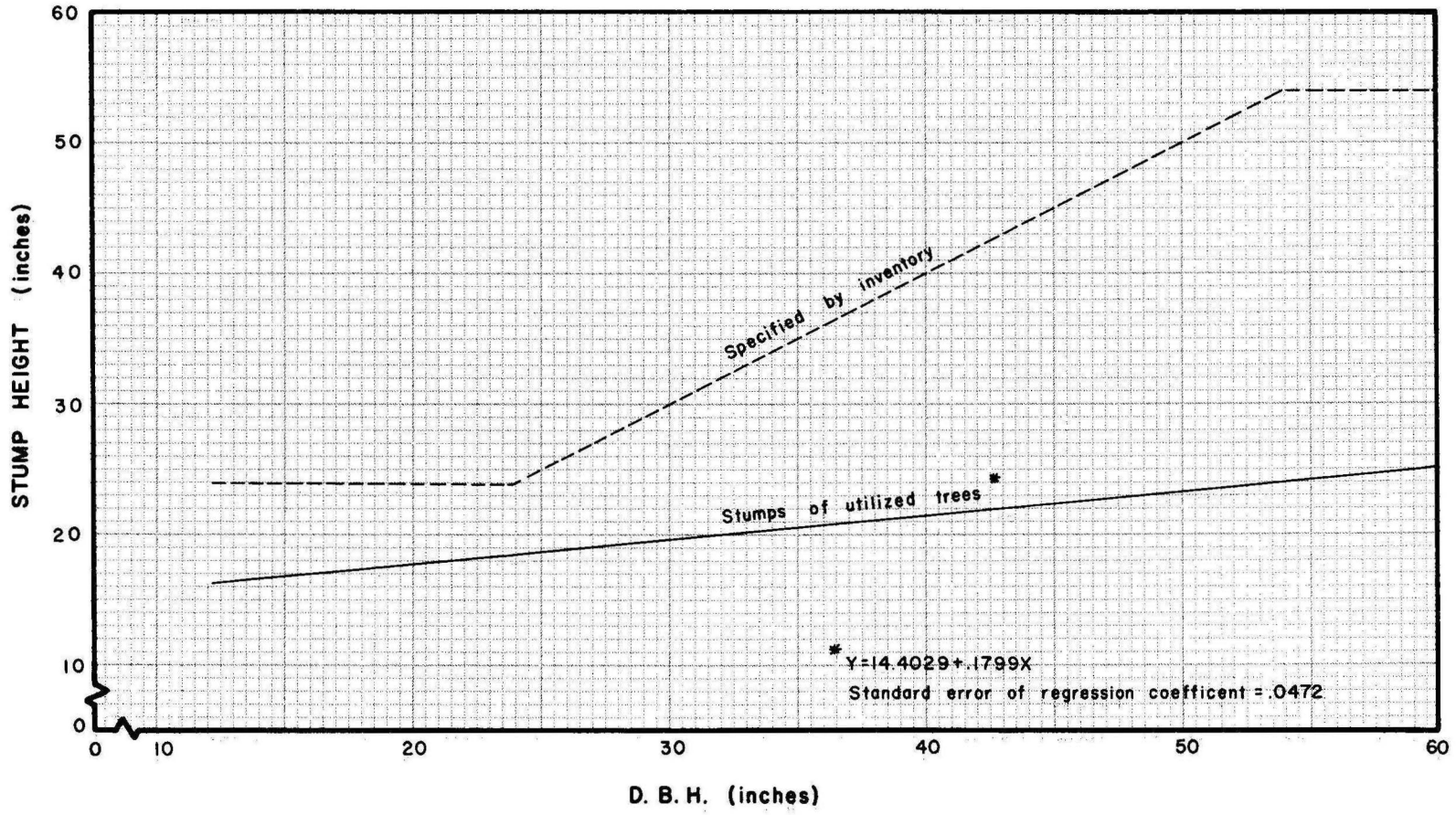

Figure 1.--Relation of utilized stump height to stump height specified in the forest inventory

Table 1.--Change in gross volume[1/] by cutting lower stumps than specified by the inventory, southeast Alaska, 1962

Average tree measured		Stump height		Length difference[2/]	Gain in volume[3/]		
D.b.h.	Height	Utilized	Inventory		Actual	16' butt log	Entire tree
Inches	No. of logs	Inches	Inches	Inches	Board feet	Percent	Percent
12	2	16.6	24.0	- 7.4	2.0	3.7	2.4
16	3	17.3	24.0	- 6.7	4.0	3.7	1.9
20	4	18.0	24.0	- 6.0	5.5	3.1	1.2
24	5	18.7	24.0	- 5.3	6.6	2.4	0.8
28	5	19.4	28.0	- 8.6	16.1	4.3	1.4
32	5	20.2	32.0	- 11.8	30.4	6.1	1.9
36	6	20.9	36.0	- 15.1	50.7	8.0	2.1
40	6	21.6	40.0	- 18.4	73.2	9.2	2.4
44	6	22.3	44.0	- 21.7	107.2	11.0	2.9
48	6	23.0	48.0	- 25.0	150.1	12.9	3.4
52	7	23.8	52.0	- 28.2	218.9	14.1	3.6
56	7	24.5	54.0	- 29.5	256.7	15.3	3.6
60	7	25.2	54.0	- 28.8	302.2	14.7	3.7

1/ Average tree dimensions applied to form class 82 volume table for volume estimates.

2/ Based on inventory stump height.

3/ Based on inventory log and tree volumes; Scribner log rule.

In contrast to the stump utilization, top utilization compared more closely to the inventory merchantable top standard (figure 2). Tree tops, however, were being less fully utilized than specified by the inventory except in the very large d.b.h. classes. Utilization equaling inventory standards was theoretically reached in 40.5-inch d.b.h. trees where top log diameters averaged 16.2-inches at the small end. Volume losses ranged from 7 to 25 board feet per tree (table 2). While the greatest board foot loss occurred in the 24-inch d.b.h. class, the greatest percentage loss in the entire tree and in the top 16-foot log occurred in the 12- and 16-inch d.b.h. classes respectively. Field observations indicate that breakage determined where the top log was bucked. Perhaps as logging shifts from today's overmature, old-growth to younger stands, the inventory top diameter specification will be more closely met in the smaller d.b.h. classes.

The volume gained by cutting lower stumps did not fully offset the volume lost in the tops of the smaller d.b.h. classes (table 3). However, lower stump utilization in the 32- and 36-inch d.b.h. classes more than cancelled losses from incomplete top utilization in these trees. In practice, higher gross volumes were being obtained for all trees above the 28-inch d.b.h. class. The relationship between gross inventory and gross utilized volume by 4-inch d.b.h. classes is expressed by the regression equation

$$Y = - 10.9834 + 0.4635X - 0.0032X^2$$

where: Y = net percent change in volume for the entire tree
X = 4-inch d.b.h. class

The coefficient of multiple determination is 0.9874. Thus, nearly 99 percent of the total variation in volume between the inventory and utilized tree is accounted for by the regression equation.

People working with inventory estimates and timber sale cruises may want to know how much of the stand will be utilized. This can be estimated by multiplying the inventory volume in each diameter class by the conversion factor given in table 3.

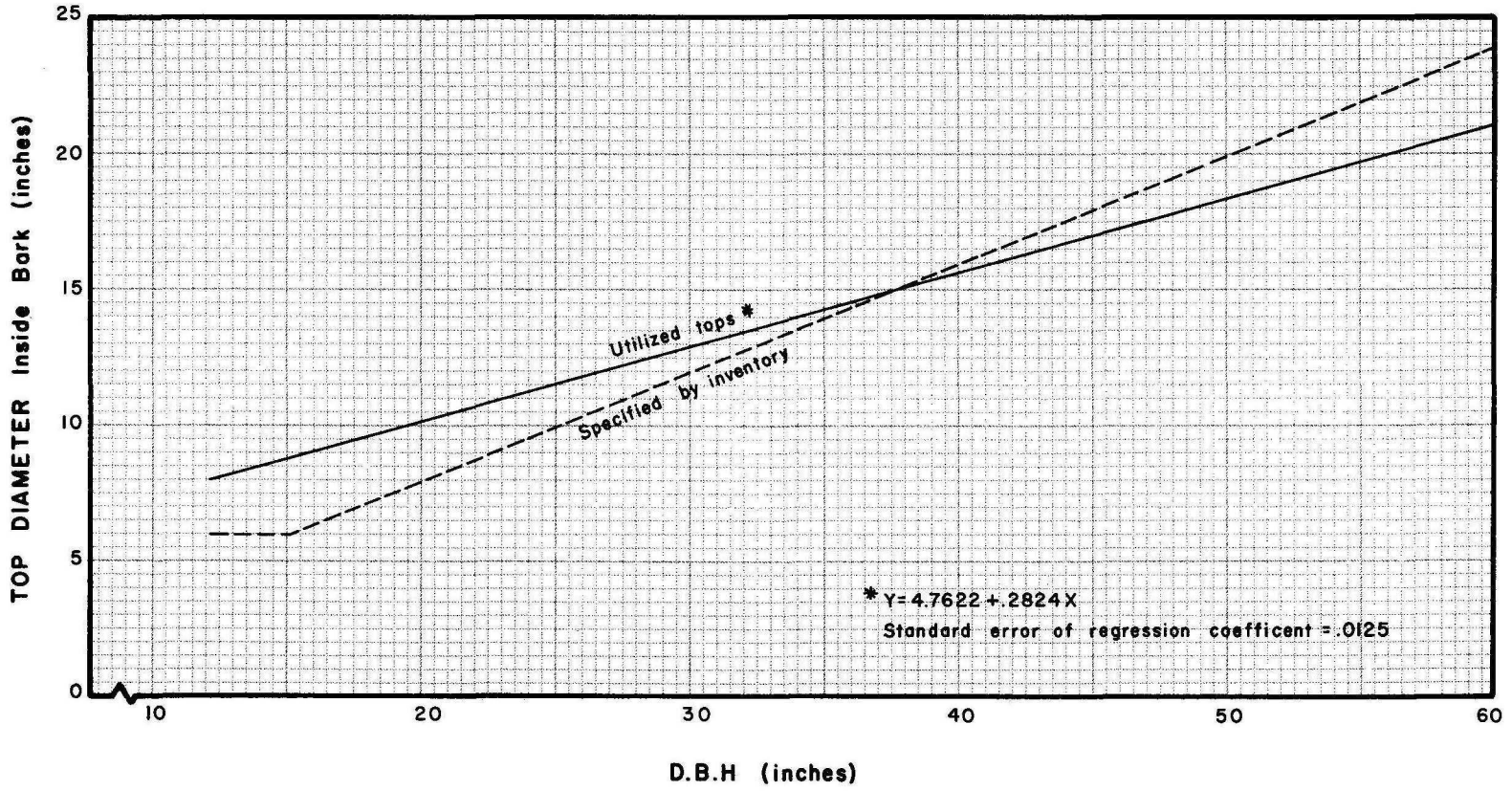

Figure 2.--Relation of utilized top diameter to merchantable top diameter specified in the forest inventory

Table 2.--Change in gross volume[1/] by cutting top diameters other than specified as merchantable by the inventory, southeast Alaska, 1962

Average tree measured		Top diameter		Length difference[2/]	Gain or loss in volume[3/]		
D.b.h.	Height	Utilized	Inventory		Actual	16' top log	Entire tree
Inches	No. of logs	Inches	Inches	Feet	Board feet	Percent	Percent
12	2	8.1	6.0	- 9.2	- 7.2	- 56.7	- 9.0
16	3	9.3	6.4	- 11.3	- 11.0	- 69.6	- 5.2
20	4	10.4	8.0	- 9.1	- 17.4	- 55.9	- 4.0
24	5	11.5	9.6	- 8.1	- 25.1	- 49.7	- 3.1
28	5	12.6	11.2	- 5.3	- 24.1	- 32.5	- 2.1
32	5	13.8	12.8	- 3.3	- 20.6	- 20.3	- 1.3
36	6	14.9	14.4	- 1.7	- 13.9	- 10.4	- 0.6
40	6	16.0	16.0	0.0	0.0	0.0	0.0
44	6	17.2	17.6	1.1	13.4	6.4	0.4
48	6	18.3	19.2	2.3	32.2	12.7	0.7
52	7	19.4	20.8	4.1	65.2	21.6	1.1
56	7	20.6	22.4	5.0	90.6	25.6	1.3
60	7	21.7	24.0	5.9	119.7	29.2	1.5

1/ Average tree dimensions applied to form class 82 volume table for volume estimates.

2/ Based on inventory top.

3/ Based on inventory log and tree volumes; Scribner log rule.

Table 3.--Total volume gains or losses resulting from cutting to different stumps and tops than specified by inventory, southeast Alaska, 1962

D.B.H.	Total volume gain or loss per tree		Conversion factors 1/
Inches	Board feet	Percent	
12	- 5.2	- 6.5	.941
16	- 7.0	- 3.3	.956
20	- 11.9	- 2.8	.970
24	- 18.5	- 2.3	.983
28	- 8.0	- 0.7	.995
32	9.8	0.6	1.006
36	36.8	1.5	1.016
40	73.2	2.4	1.024
44	120.6	3.3	1.032
48	182.3	4.1	1.039
52	284.1	4.7	1.045
56	347.3	4.9	1.050
60	421.9	5.2	1.053

1/ Ratio of utilized to inventory volume.

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